GEMSTONES

What are gemstones?

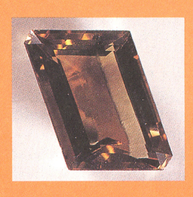
Gemstones are minerals and organic materials that have special characteristics making them desirable for jewellery and ornaments. They grow through natural processes, unlike an increasing number of imitation or synthetic materials that are produced artificially.

Gemstones are set apart from other minerals by their beauty, durability and rarity. The most important of these characteristics is beauty, which is based on the gemstone's colour, clarity, brilliance, pattern and light-reflecting qualities. Gemstones must also be durable, or in other words sufficiently resistant to abrasion and breakage to be used in jewellery. The beauty and clarity of a gemstone may be enhanced by procedures such as heating, irradiation, oiling, dyeing and laser drilling.

Some gemstones, such as pearls or natural crystals like quartz (right) are formed perfectly by nature and require no cutting or polishing. Others must be cut and polished to reveal their full beauty.

Transparent gems, such as diamonds, are cut with flat faces known as facets, while opal, jade and other translucent and opaque gems are cut with domed surfaces in the cabochon style. Some gemstones are suitable for carving, and others can be ground into beads of various shapes. Another popular method, especially with hobbyists, is to polish stones into freeform shapes by tumbling them in an abrasive solution.

The gem-cutter and jeweller must use care in cutting, setting, handling, repairing and testing gems. Most stones can be chipped if they are dropped or knocked against a hard object. Some stones are sensitive to significant temperature changes or to acids. With normal care, however, gemstones will last forever.

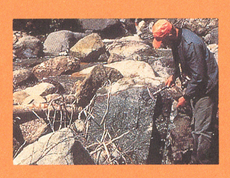


The value of a gem is determined by a number of factors, including its beauty, flawlessness, rarity, the perfection of its cut and polish, its size or weight, and, not to be underestimated, the demands of fashion. The value of faceted stones such as this smoky quartz (left) is based on their weight in carats (one carat equals 200 milligrams), while that of cabochons is based on their size in millimetres.

Gems are identified and evaluated by highly trained specialists called gemmologists who use special instruments and non-destructive techniques to distinguish one gemstone from another, or natural gemstones from synthetic materials.

Gemstones occur in all types of rock. The most important source is granite pegmatite (a very coarse-grained igneous rock) which produces a wide assortment of coloured gems, including topaz, tourmaline (right), spodumene, aquamarine and other beryls, and the quartz and feldspar gems. Other igneous rocks may yield diamond and amethyst, and some volcanic rocks contain sapphire, zircon, agate and jasper. Sedimentary rocks may produce turquoise and opal, whereas most garnet, ruby and lapis lazuli are formed in metamorphic rocks. Gravels derived from the breakdown of these rocks are important sources of gemstones.

Africa, southeast Asia, Sri Lanka, India, Brazil and Australia are among the world's most important suppliers of gemstones. The recovery of gemstones is generally small-scale, with production driven by demand. Recovery methods include panning, sluicing and hand-sorting of gravels, as well as underground and surface mining operations (as shown left). Great care is taken during the drilling, blasting and recovery process to avoid damaging the rough gemstone materials.



Canada's diverse geology yields a wide range of gemstones that are popular on the world market. These include jade and rhodonite from British Columbia and Yukon Territory; amethyst, sodalite and rose quartz from Ontario; labradorite from Labrador; hessonite garnet from Quebec; and ammonite fossils from Alberta. Diamonds have been found in Canada, and several discoveries have been made recently of kimberlite, a rock that may contain diamond.

Gemstones and you

The collection and fashioning of gemstones can be an exciting and rewarding pastime, and surprisingly inexpensive. Considering the lasting beauty and value of gem materials, it is little wonder that it has become a popular hobby in Canada.

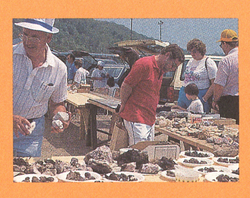
Among amateurs, the most commonly collected and fashioned gemstones are from the quartz and feldspar mineral families. The feldspars include labradorite, perthite, peristerite, amazonite, sunstone and oligoclase. Quartz gemstones, which feature diverse colours and patterns, include rose quartz, amethyst, citrine, rock crystal, petrified wood, agate and jasper.

Some hobbyists seek out lesser-known gem materials, including zoisite, vesuvianite, scapolite, diopside, xonotlite, epidote, apatite and cordierite. Sculptors, on the other hand, find jade, soapstone, pyrophyllite, serpentine and alabaster suitable for carving.

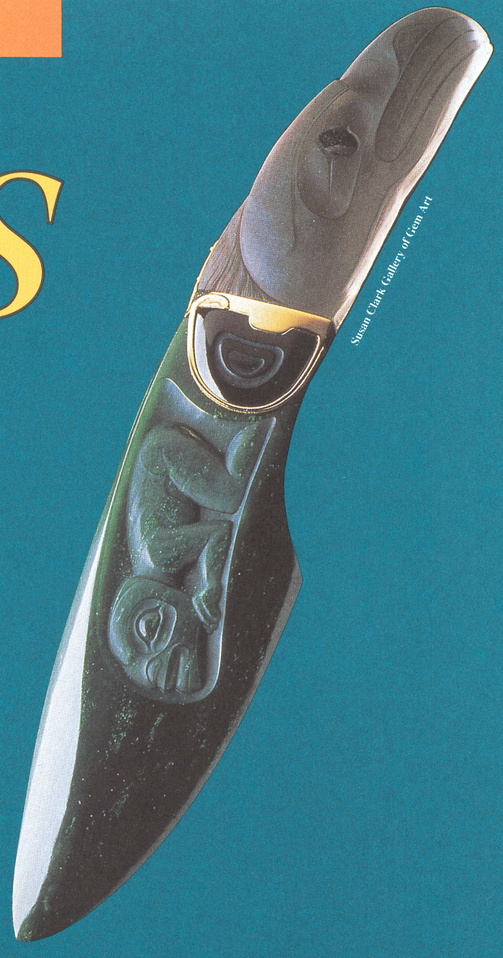
Attractively coloured or patterned rocks are also cut and polished for ornamental objects. These rocks include breccia, porphyry, marble, jasper conglomerate, green chrome-mica rock and fossil-bearing limestone. Red granite – streaked and mottled with yellow-green epidote – is another striking ornamental rock.

Lakeshores, ocean bays, river beds and gravel pits are some of the more popular sites for amateur gemstone collectors. They may contain agate, jasper, jade, rhodonite, gold nuggets, fossil ivory, cassiterite and hematite. Some mines also furnish a variety of gem materials for the hobbyist as well as for export.

Hobbyists, also known as amateur lapidaries, display their cut stones, jewellery and ornamental objects at gem and mineral shows. These popular events, like the Bancroft Gemboree in Ontario (right), are held annually in many locations across Canada and are generally sponsored by local lapidary and mineral clubs.

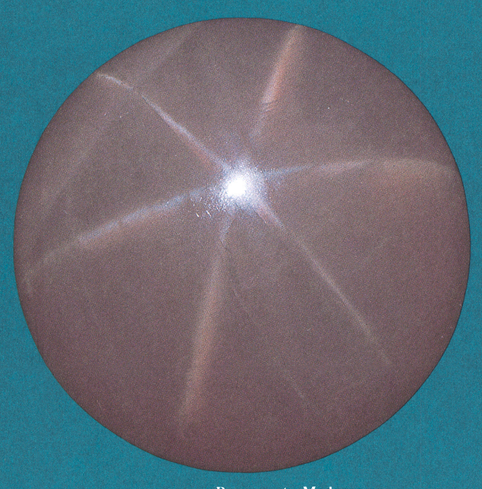


The Geological Survey of Canada publishes a series of regional guidebooks that describe mineral, rock and fossil localities in various areas of Canada accessible to collectors. Another annual publication, "Information for Collectors", outlines the basics for collecting and has additional reading suggestions and lists of mineral and gem clubs and dealers across Canada. For further information contact: Geological Survey of Canada, 601 Booth Street, Ottawa, Ontario K1A OE8



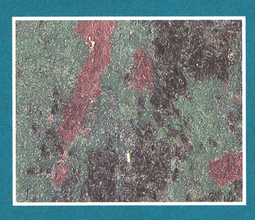
Susan Clark Gallery of Gem Art

The distinctive styles of Canadian gemstone carvers and sculptors have gained them national as well as international acclaim. This carving, "The Potlatch Knife", by Canadian gemstone carver Thomas McPhee, uses design motifs of the Northwest Coast Indians. The blade is made of nephrite jade from the Cassiar Mine in British Columbia. The handle is made of rock crystal (quartz) from Brazil, black nephrite jade from the United States, and 18K yellow gold.



Rose quartz, Madagascar.

Unusual, eye-catching optical effects are created by the play of light in some gemstones, such as the mysterious six-ray star in this rose quartz. These optical effects are caused by structural peculiarities or inclusions of foreign minerals trapped during the growth of the gemstone. By examining inclusions, gemmologists and mineralogists can tell if the stone is natural or synthetic, and how, when and where it was formed.



Ruby in zoisite, Tanganyika.

The colour of most gemstones is due to the presence of metallic elements like chromium, iron, manganese, titanium or copper, inside the gem crystal, or because of a structural irregularity. This ruby is red because it contains a small amount of chromium.

Light rays reflected from the surface and interior of a gem produce brilliance.

Tino Hammid © 1987

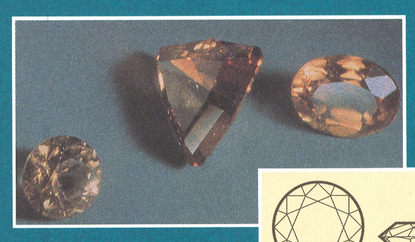
Diamond.

The brilliance of a cut gemstone results from a combination of refraction, dispersion, and surface and internal reflection of light. As light rays enter a transparent stone, they are refracted (or bent) due to the difference in optical density between the stone and air – the bent appearance of a stick thrust into a pool of water is due to refraction. Like a prism, a gemstone may also disperse light into its rainbow colours. The refracted and dispersed light rays are internally reflected within the stone and back to the eye. The gemcutter's art lies in accurately cutting facets in the stone to enhance these optical effects.

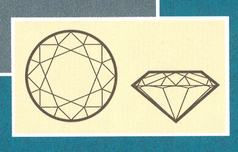
Cabochon-style cut.

Gemcutters (or lapidaries) use certain styles of cut to enhance the beauty of a gemstone. Cabochon cuts, round or oval with dome-like surfaces, are generally used for opaque or translucent gemstones and are the oldest and simplest cuts. Gemstones cut into flat, highly polished surfaces (called brilliant or step cuts) are examples of faceted styles; these cuts are used for diamonds and other transparent stones.

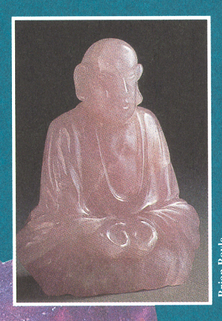
Polished agate cabochon, Souris, Manitoba.



Grossular hessonite garnet, Jeffrey Mine, Asbestos, Quebec.



Faceted-style cut.



Brian Boyle

Rose quartz Buddha from the collection of the Royal Ontario Museum.

Quartz var. citrine, Villedieu Tp., Quebec, from the collection of the Royal Ontario Museum.

Brian Boyle

Quartz var. amethyst, Thunder Bay, Ontario.

What do amethyst, citrine, rose quartz, agate and jasper have in common? They are all gem varieties of quartz. Quartz is one of the most common minerals and is found all over the globe. Although colourless and transparent in its purest form (rock crystal), quartz comes in a range of colours including violet amethyst, yellow citrine and rose quartz, or as multi-coloured agate and jasper.

Diamond Information Centre

Labradorite has been quarried since it was first found off the coast of Labrador in the early 1770s. Esteemed for its unique wandering shimmer of blue light, labradorite was the inspiration for this award-winning pendant-brooch by Canadian jewellery designer Don Stuart.

Agate butterfly, Exposition Universelle, 1878, Paris.

Jasper conglomerate vase, 1876 International Exhibition, Philadelphia, U.S.A.

Gemstones have a long history in Canada. These pieces were commissioned by Sir William Logan, the first director of the Geological Survey of Canada, as part of a collection shown at international exhibitions. The Grand Industrial Exhibition, the first great world exhibition, took place in 1851 at the Crystal Palace in London, England. Canada showed a mineral and gemstone collection of specimens from areas mapped from 1842 to 1850. These specimens, as was intended, caused great interest and sparked European investment in Canadian minerals.

Canadian Museum of Civilization

By examining ancient gemstone artifacts, archaeologists can learn much about the cultures that used them to make tools, weapons and decorative objects. Jade tools such as this 1000-year-old nephrite jade celt (chisel) found in British Columbia were used by the Salish people of the Fraser River area.

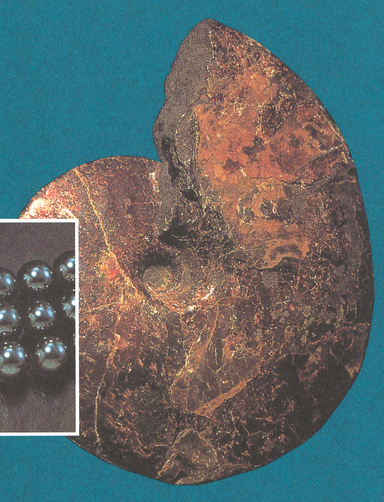
Nodules (lumps) of amber in coal-bearing rocks can be found today on Ellesmere Island in the High Arctic. Centuries ago, the Thule people of this area collected this amber and used it to create ornamental objects.

Canadian Museum of Civilization

Amber beads, Thule culture, A.D. 1000-1600.

Jewels by Design Ltd.

Ammolite® and hematite necklace, an award-winning design by Canadian LLyn Strelau.

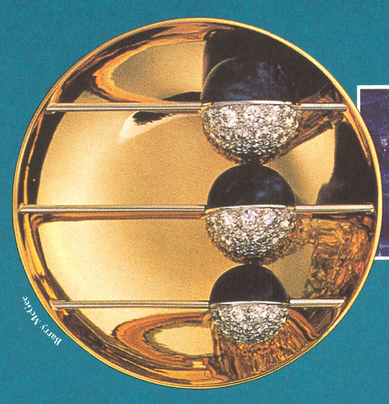


Cretaceous ammonite **Placenticeras meeki** *is the source of Canada's newest gemstone, but its history goes back 75 million years. Found in southern Alberta, the fossilized shells of the marine mollusc, ammonite, lie buried in the shale rock of what was once the bed of the prehistoric Bearpaw Sea.*

Peter Faulkbonner, Simon Fraser University

Cultured abalone pearl, Vancouver Island, B.C.

Pearls, known as organic gems, are produced by oysters, mussels and abalone. These animals secrete a substance called nacre, made up of layers of calcium carbonate which form a pearl. The secretion is a response to an irritant like a grain of sand.



Burts Mieke

Mined in Bancroft, Ontario, sodalite is popular among hobbyists and collectors because it is tough, easy to cut and has a rich colour. These qualities made it a good choice for Canada's wedding gift to Lady Diana in 1981. Created by award-winning Montreal designer, Georges Schwartz, the brooch is made of Canadian sodalite, gold and platinum; the diamonds are from Africa.

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Unless otherwise indicated photos are of specimens from the collections of the Geological Survey of Canada and the Canadian Museum of Nature.

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